General

Guideline Title

ACR Appropriateness Criteria® low back pain.

Bibliographic Source(s)

Patel ND, Broderick DF, Burns J, Deshmukh TK, Fries IB, Harvey HB, Holly L, Hunt CH, Jagadeesan BD, Kennedy TA, O'Toole JE, Perlmutter JS, Policeni B, Rosenow JM, Shroeder JW, Whitehead MT, Cornelius RS, Corey AS, Expert Panel on Neurologic Imaging. ACR Appropriateness CriteriaÂ® low back pain. Reston (VA): American College of Radiology (ACR); 2015. 12 p. [30 references]

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Davis PC, Wippold FJ II, Cornelius RS, Angtuaco EJ, Broderick DF, Brown DC, Garvin CF, Hartl R, Holly L, McConnell CT Jr, Mechtler LL, Rosenow JM, Seidenwurm DJ, Smirniotopoulos JG, Expert Panel on Neurologic Imaging. ACR Appropriateness Criteria® low back pain. [online publication]. Reston (VA): American College of Radiology (ACR); 2011. 8 p. [48 references]

This guideline meets NGC's 2013 (revised) inclusion criteria.

Recommendations

Major Recommendations

ACR Appropriateness Criteria®

Clinical Condition: Low Back Pain

Variant 1: Acute, subacute, or chronic uncomplicated low back pain or radiculopathy. No red flags. No prior management.

Radiologic Procedure	Rating	Comments	RRL*
MRI lumbar spine without contrast	2		O
X-ray lumbar spine	2		☢☢☢
X-ray myelography and post-myelography CT lumbar spine	2		☢☢☢☢
Tc-99m bone scan with SPECT spine	2	If there is concern for spondylolysis in a young patient, SPECT/CT remains the gold standard.	☢☢☢
CT lumbar spine without contrast	2		☢☢☢

Radiologic Procedure	Rating	Comments	RRL*
CT lumbar spine with contrast	2		☢☢☢
MRI lumbar spine without and with contrast	2		O
CT lumbar spine without and with contrast	1		☢☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 2: Acute, subacute, or chronic uncomplicated low back pain or radiculopathy. One or more of the following: low velocity trauma, osteoporosis, elderly individual, or chronic steroid use.

Radiologic Procedure	Rating	Comments	RRL*
X-ray lumbar spine	7	This procedure is recommended as the initial imaging study, especially in patients with osteoporosis or history of steroid use.	☢☢☢
CT lumbar spine without contrast	7	If there remains concern for vertebral body fracture, detailed osseous analysis with CT can be performed for further evaluation.	☢☢☢
MRI lumbar spine without contrast	7	CT is preferred. MRI can be useful to evaluate for ligamentous injury or worsening neurologic deficit. MRI can depict marrow edema in these scenarios.	O
Tc-99m bone scan with SPECT spine	3	Bone scan with SPECT/CT can be useful for radiographically occult fractures and problem solving.	☢☢☢
CT lumbar spine with contrast	3		☢☢☢
CT lumbar spine without and with contrast	1		☢☢☢☢
X-ray myelography and post-myelography CT lumbar spine	1		☢☢☢☢
X-ray discography and post-discography CT lumbar spine	1		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 3: Acute, subacute, or chronic low back pain or radiculopathy. One or more of the following: suspicion of cancer, infection, or immunosuppression.

Radiologic Procedure	Rating	Comments	RRL*
MRI lumbar spine without and with contrast	8	Contrast is useful for neoplasia subjects suspected of epidural or intraspinal disease.	O
MRI lumbar spine without contrast	7	Noncontrast MRI can be sufficient if there is low risk of epidural and/or intraspinal disease.	O
CT lumbar spine with contrast	6	MRI is preferred. CT is useful if MRI is contraindicated or unavailable, and/or for problem solving.	☢☢☢
CT lumbar spine without and with contrast	2	MRI is preferred. CT is useful if MRI is contraindicated or unavailable, and/or for problem	☢☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Radiologic Procedure	Rating	Comments	RRL*
X-ray lumbar spine	5	solving.	☢☢☢
Tc-99m bone scan whole body with SPECT spine	4	SPECT/CT can be useful for anatomic localization and problem solving, in particular if looking for widespread tumor burden. It is valuable when multifocal metastases are suspected.	☢☢☢
FDG-PET/CT whole body	4	MRI is preferred. This procedure can be indicated if MRI is contraindicated or nondiagnostic. It can distinguish benign versus malignant compression fractures.	☢☢☢☢
CT lumbar spine without and with contrast	3	MRI is preferred. This procedure can be indicated if MRI is contraindicated or nondiagnostic.	☢☢☢☢
X-ray myelography and post-myelography CT lumbar spine	3	MRI is preferred. This procedure can be indicated if MRI is contraindicated or nondiagnostic and can be useful for anatomic localization and problem solving.	☢☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 4: Acute, subacute, or chronic low back pain or radiculopathy. Surgery or intervention candidate with persistent or progressive symptoms during or following 6 weeks of conservative management.

Radiologic Procedure	Rating	Comments	RRL*
MRI lumbar spine without contrast	8		O
CT lumbar spine with contrast	5	MRI is preferred. CT is useful if MRI is contraindicated or unavailable, and/or for problem solving.	☢☢☢
CT lumbar spine without contrast	5	MRI is preferred. CT is useful if MRI is contraindicated or unavailable, and/or for problem solving.	☢☢☢
MRI lumbar spine without and with contrast	5	This procedure is indicated if noncontrast MRI is nondiagnostic or indeterminate. Contrast is indicated if patient has history of prior lumbar surgery. See Variant 5 below.	O
X-ray myelography and post-myelography CT lumbar spine	5	MRI is preferred. This procedure can be indicated if MRI is contraindicated or nondiagnostic.	☢☢☢☢
X-ray lumbar spine	4	This procedure is usually not sufficient for decision making without MR and/or CT imaging but can be helpful in surgical planning.	☢☢☢
Tc-99m bone scan with SPECT spine	4	This procedure can be particularly useful for facet arthropathy or stress fracture. SPECT/CT can be useful for anatomic localization and problem solving.	☢☢☢
X-ray discography and post-discography CT lumbar spine	3	Although controversial, this can be useful in patients with >3 months of LBP (chronic LBP patients).	☢☢☢
CT lumbar spine without and with contrast	3		☢☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 5: Low back pain or radiculopathy. New or progressing symptoms or clinical findings with history of prior lumbar surgery.

Radiologic Procedure	Rating	Comments	RRL*
MRI lumbar spine without and with contrast	8	This procedure can differentiate disc from scar.	O
CT lumbar spine with contrast	6	This is most useful in postfusion patients or when MRI is contraindicated or indeterminate.	☢☢☢
CT lumbar spine without contrast	6	This is most useful in postfusion patients or when MRI is contraindicated or indeterminate.	☢☢☢
MRI lumbar spine without contrast	6	Contrast is often necessary.	O
X-ray myelography and post-myelography CT lumbar spine	5		☢☢☢☢
X-ray lumbar spine	5	Flexion and extension views can be useful.	☢☢☢
Tc-99m bone scan with SPECT spine	5	This procedure helps detect and localize painful pseudoarthrosis. SPECT/CT can be useful for anatomic localization and problem solving.	☢☢☢
X-ray discography and post-discography CT lumbar spine	5		☢☢☢
CT lumbar spine without and with contrast	3		☢☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 6: Low back pain with suspected cauda equina syndrome or rapidly progressive neurologic deficit.

Radiologic Procedure	Rating	Comments	RRL*
MRI lumbar spine without contrast	9	Use of contrast depends on clinical circumstances.	O
MRI lumbar spine without and with contrast	8	Use of contrast depends on clinical circumstances.	O
X-ray myelography and post-myelography CT lumbar spine	6	This procedure is useful if MRI is nondiagnostic or contraindicated.	☢☢☢☢
CT lumbar spine with contrast	5		☢☢☢
CT lumbar spine without contrast	5		☢☢☢
X-ray lumbar spine	3		☢☢☢
CT lumbar spine without and with contrast	3		☢☢☢☢
Tc-99m bone scan with SPECT spine	2		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Summary of Literature Review

Introduction/Background

In the United States, acute low back pain (LBP) with or without radiculopathy is the leading cause of years lived with disability and the third

ranking cause of disability-adjusted life years. It is the second most common reason for a physician visit and affects 80% to 85% of people over their lifetime.

The American College of Physicians and the American Pain Society classify LBP into the following broad categories: nonspecific LBP, back pain potentially associated with radiculopathy or spinal stenosis, and back pain potentially associated with another specific spinal cause. Additionally, guidelines from the American College of Physicians and the American Pain Society emphasize a focused history and physical examination, reassurance, initial pain management medications if necessary, and consideration of physical therapies without routine imaging in patients with nonspecific LBP. Duration of symptoms also helps guide treatment algorithms in patients with acute, subacute, or chronic LBP. Additionally, assessment of psychosocial risk factors when obtaining patient history is a strong predictor of patients who are predisposed to developing chronic disabling LBP problems.

Although there is great variability in the definition of acute and subacute LBP, for the purposes of this guideline, the expert panel will use the Institute for Clinical Systems Improvement definitions of 0 to 6 weeks to definite acute LBP, 6 to 12 weeks for subacute LBP, and >12 weeks to define chronic LBP.

It is now clear that *uncomplicated* acute LBP and/or radiculopathy is a benign, self-limited condition that does not warrant any imaging studies. Imaging is considered in those patients who have had up to 6 weeks of medical management and physical therapy that resulted in little or no improvement in their back pain. It is also considered for those patients presenting with red flags raising suspicion for a serious underlying condition, such as cauda equina syndrome (CES), malignancy, fracture, or infection (see table below).

Table. Red Flags: Indications of a More Complicated Status Include Back Pain/Radiculopathy in the Following Settings

Red Flag	Potential Underlying Condition as Cause of Low Back Pain (LBP)
• History of cancer • Unexplained weight loss • Immunosuppression • Urinary infection • Intravenous drug use • Prolonged use of corticosteroids • Back pain not improved with conservative management	Cancer or infection
• History of significant trauma • Minor fall or heavy lift in a potentially osteoporotic or elderly individual • Prolonged use of steroids	Spinal fracture
• Acute onset of urinary retention or overflow incontinence • Loss of anal sphincter tone or fecal incontinence • Saddle anesthesia • Global or progressive motor weakness in the lower limbs	Cauda equina syndrome or severe neurologic compromise

Previous guidelines have suggested that imaging be performed in adults older than 50 years who present with LBP. A recent study found no statistically significant difference in primary outcome after 1 year for older adults who had spine imaging within 6 weeks after an initial visit for care for LBP versus similar patients who did not undergo early imaging; thus, this panel does not include age older than 50 as an independent red flag.

Additionally, for those patients without neurologic compromise and who present with minor risk factors for cancer, inflammatory back disease (e.g., ankylosing spondylitis), vertebral compression fracture, or symptomatic spinal stenosis, imaging should be considered after a trial of therapy.

In the majority of patients, no specific pathology for LBP can be identified. Previous studies have shown imaging abnormalities in a substantial number of people without back pain. The challenge for the clinician, therefore, is to distinguish the small segment within this large patient population that should be evaluated further because of suspicion of a more serious problem.

Overview of Imaging Modalities

Many imaging modalities are available to the clinician and radiologist for evaluating LBP. Application of these modalities largely depends on the working diagnosis, the urgency of the clinical problem, and comorbidities of the patient. Radiographs of the lumbar spine are not routinely recommended in acute nonspecific LBP because they are of limited diagnostic value. Radiography is the initial imaging study of choice for assessing

LBP in patients with a history of trauma and patients suspected of possible vertebral compression fracture. Flexion and extension views can be performed to evaluate for spine stability.

In addition, radiographs are recommended to evaluate a young patient for ankylosing spondylitis. Those deemed to be interventional candidates, with LBP lasting for >6 weeks having completed conservative management with persistent radiculopathic symptoms, may seek magnetic resonance imaging (MRI). Patients with severe or progressive neurologic deficit on presentation and red flags should be evaluated with MRI.

Computed tomography (CT) scans provide superior bone detail but are not as useful in depicting extradural soft-tissue pathologies such as disc disease when compared with multiplanar MRI. Intradural and cord pathologies are poorly assessed on CT but are well seen with MRI. CT with multiplanar reformatted sagittal and coronal planes is useful for depicting bone structural problems such as spondylolysis, pseudoarthrosis, fracture, scoliosis, and stenosis and for postsurgical evaluation of bone graft integrity, surgical fusion, and instrumentation. In patients who cannot undergo MRI, CT with myelography can be performed to assess the patency of the spinal canal/thecal sac and of the neural foramen. Myelography suffers the disadvantage that it requires an invasive procedure to introduce intrathecal contrast agents.

The use of provocative injections in the lumbar spine to identify a discogenic source of pain remains controversial. Discography is a subjective test, relying entirely on the patient's description of pain during the procedure. The role of the isotope bone scan in patients with acute LBP has changed in recent years with the wide availability of MRI and especially contrast-enhanced MRI. Technetium (Tc)-99m-MDP bone scan with single-photon emission computed tomography (SPECT) is a sensitive test for detecting the presence of infection or occult fractures of the vertebrae, but not for specifying the diagnosis.

Discussion of Imaging Modalities by Variant

Variant 1: Acute, Subacute, or Chronic Uncomplicated Low Back Pain or Radiculopathy. No Red Flags (red flags defined in the table above). No Prior Management

The natural history of acute LBP, with or without radiculopathy, is considered a self-limiting condition in most patients. Additionally, imaging patients with acute LBP of <6 weeks' duration and no red flag symptoms provides no clinical benefit. Numerous studies have shown that routine imaging is not beneficial. The majority of disc herniations reabsorb or regress by 8 weeks after symptom onset.

Similarly, in patients with chronic LBP who do not present with red flags, first-line treatment remains conservative therapy with both pharmacologic and nonpharmacologic (e.g., exercise, remaining active) therapy without imaging.

One prospective study found that among patients with lumbar imaging abnormalities before the onset of LBP, 84% had unchanged or improved findings after symptoms developed. Adding to this controversy, nonspecific lumbar disc abnormalities are common in asymptomatic patients and can be demonstrated readily on MRI, CT, x-ray myelography, and post-myelography CT of the lumbar spine.

Recently, a systematic review of 33 articles found an increasing prevalence of degenerative spine findings in asymptomatic patients of increasing age. For example, disk protrusion prevalence increased from 29% of those 20 years of age to 43% of those 80 years of age in this asymptomatic population.

In a young patient with suspicion for lumbar spondylolysis, the gold standard in detection of radiographically occult active spondylolysis has been SPECT. There are disadvantages of this method, related not only to the invasive injection of a radiotracer but also to the concurrent radiation exposure. Recently, a group of researchers have similarly shown the utility of MRI in diagnosing active spondylolysis in radiographically occult spondylolysis.

Variant 2: Acute, Subacute, or Chronic Uncomplicated Low Back Pain or Radiculopathy. One or More of the Following: Low Velocity Trauma, Osteoporosis, Elderly Individual, or Chronic Steroid Use

In patients with history of osteoporosis or with history of steroid use, initial evaluation with radiographs is recommended. Radiography with anteroposterior and lateral radiographs is the initial imaging study of choice for assessing LBP in patients with a low suspicion of trauma and patients suspected of possible vertebral compression fracture. Flexion and extension views can be performed to evaluate for spine stability. Disadvantages of lumbar radiography include gonadal exposure. Additionally, evaluation of the extent of vertebral body comminution is limited on radiography.

As recommended in the National Guideline Clearinghouse (NGC) summary of the ACR Appropriateness Criteria® suspected spine trauma, any patient meeting the high-risk criteria for having a vertebral injury should undergo CT. CT provides a detailed analysis of fractures extending to the posterior column of the vertebra or for evaluating the integrity of pedicles and the posterior cortex. Additionally, CT with multiplanar reformatted sagittal and coronal planes can help detect subtle fractures.

In trauma patients, MRI can be useful in evaluating the appearance of the stabilizing spinal ligaments; in assessing for presence of hemorrhage in the epidural, subdural, subarachnoid, and intramedullary locations; and in demonstrating spinal canal compromise, for example, from disc herniations and displaced fractures. Traumatic injuries are usually imaged with T1, T2, and short tau inversion recovery (STIR) sequences. Acuity of fracture, as evidenced by bone marrow edema, can be assessed on STIR sequences. Additionally, the distinction between malignant and benign compression fractures can be assessed on MRI. The visualization of the convex posterior vertebral body border, extension into the posterior elements, and abnormal marrow signal are suggestive of pathologic fracture. In patients with suspicion for disk herniation and in whom MRI is contraindicated or nondiagnostic, x-ray myelography and post-myelography CT could be performed.

Nuclear medicine has a limited role in the evaluation of patients suspected of lumbar spine trauma.

Variant 3: Acute, Subacute, or Chronic Low Back Pain or Radiculopathy. One or More of the Following: Suspicion of Cancer, Infection, or Immunosuppression

A systematic review examining studies that used red flags as an indication for screening found that of all the red flags, only a history of cancer has been shown to increase the probability of finding spinal malignancy. In a patient suspected of having cancer, MRI with contrast is considered superior in evaluation of localizing disease (intramedullary, intradural-extramedullary, extradural) as well as assessing extent of the lesion. Intradural and cord pathologies are poorly depicted on CT. CT can be performed to evaluate osseous involvement of tumor. MRI offers greater specificity than bone scan, with comparable sensitivity and the added advantage of providing anatomic detail. Bone scan remains invaluable when a survey of the entire skeleton is indicated (e.g., for metastatic disease). Although osseous destruction as well as identifying lytic or sclerotic lesions can be detected on radiography, at least half of the bone must be eroded before there is a noticeable change on radiographs. It has been noted that fluorine-18-2-fluoro-2-deoxy-D-glucose positron emission tomography (FDG-PET) can be useful in differentiating benign from malignant compression fractures. This modality could be of benefit in patients unable to undergo MR evaluation.

In a patient with suspected spinal infection, MRI is preferred due to its high sensitivity and specificity. MRI can localize the site of infection and assess the extent of extradural/epidural and paravertebral involvement. The addition of intravenous contrast with fat suppression is invaluable in identifying abscess formation. Again, MRI allows the diagnosis of infection before bone destruction is evident on either CT or radiography. Noncontrast and contrast-enhanced MRI has the ability to demonstrate inflammatory, neoplastic, and most traumatic lesions as well as to show anatomic detail not available on isotope studies. Thus, MRI has taken over the role of the isotope scan in many cases where the location of the lesion is known.

Variant 4: Acute, Subacute, or Chronic Low Back Pain or Radiculopathy. Surgery or Intervention Candidate with Persistent or Progressive Symptoms During or Following 6 Weeks of Conservative Management

Patients presenting with acute, subacute, or chronic LBP and radiculopathy who have failed 4 to 6 weeks of conservative care and with physical examination signs of nerve root irritation should be imaged if they are believed to be candidates for surgery or if diagnostic uncertainty remains. MRI of the lumbar spine has become the initial imaging modality of choice in complicated LBP, displacing myelography and CT in recent years. Accurate diagnosis of disc disease can be provided by MRI. Multidisciplinary agreement on terminology facilitates reporting of MRI findings, although inter-rater reliability of reporting using lumbar disc terminology has achieved only modest agreement.

Although disc abnormalities are common on MRI in asymptomatic patients, acute back pain with radiculopathy or clinical signs of spinal stenosis suggests the presence of demonstrable nerve root compression on MRI. In a study of symptomatic patients, there was a higher prevalence of herniation, 57% in patients with LBP and 65% in patients with radiculopathy, than the 20% to 28% prevalence reported in asymptomatic series. Interestingly, the size and type of disc herniation and location and presence of nerve root compression were not related to patient outcome. A recent study found no statistically significant difference in primary outcome after 1 year for older adults who had spine imaging within 6 weeks after an initial visit for care for LBP versus similar patients who did not undergo early imaging.

In the absence of red flags, first-line treatment for chronic LBP remains conservative therapy with both pharmacologic and nonpharmacologic (e.g., exercise, remaining active) therapy. It is well documented that imaging patients with chronic LBP is often not beneficial and similar imaging findings are often present in asymptomatic individuals. Additionally, patients with new episodes of LBP and previous MRI scans are unlikely to detect changes in disc protrusion, annular fissures, high-intensity zones, or end-plate signal changes with repeated MRI.

CT can be performed if a contraindication exists to performing MRI. Additionally, in patients who cannot undergo MRI, x-ray myelography with post-myelography CT of the spine can be performed to assess the patency of the spinal canal/thecal sac and of the neural foramen. Radiography is usually not sufficient for decision making without MRI and/or CT imaging, though it can be of benefit for surgical planning.

Although the usefulness of discography in patients with LBP remains controversial, a recent systematic review provides fair evidence supporting the accuracy and usefulness of lumbar discography in patients with chronic LBP. Nuclear medicine has a limited role in the evaluation of patients with persistent or progressive symptoms during or following 6 weeks of conservative management.

Variant 5: Low Back Pain or Radiculopathy. New or Progressing Symptoms or Clinical Findings with History of Prior Lumbar Surgery

There are many causes of back pain following surgery. Some of the more frequent etiologies diagnosed with imaging include free disc or bone fragments, postoperative scarring, failure of bone graft for fusion, and recurrent disc protrusion. Contrast-enhanced MRI allows the distinction between recurrent disc herniation and scar when abnormal tissue extends beyond the disc interspace. In patients who cannot undergo MRI or in whom anatomy is distorted secondary to artifacts from surgical hardware, x-ray myelography with a post-myelography CT spine study is complementary to MRI and is occasionally more accurate in diagnosing nerve root compression in the lateral recess, but it suffers the disadvantage of requiring lumbar puncture and intrathecal contrast injection. Evaluation of bone graft integrity, surgical fusion, and instrumentation can readily be performed with CT. Radiographs have a role in evaluation of alignment and instability and in the postoperative evaluation of instrumentation and fusion.

Variant 6: Low Back Pain with Suspected Cauda Equina Syndrome or Rapidly Progressive Neurologic Deficit

Cauda equina syndrome (CES) is rare and results from dysfunction of the sacral and lumbar nerve roots within the vertebral canal, producing impairment of the bladder, bowel, or sexual function and perianal or saddle numbness. Back pain with or without radicular symptoms, weakness in the lower limbs, sensory changes or numbness in the lower limbs, or absent lower limb reflexes are other symptoms that have been described. A review of physical examination findings reported by a group of authors illustrates that the most common physical finding in patients with the diagnosis of CES was LBP. A prospective cohort study recommends urgent MRI assessment in all patients who present with new-onset urinary symptoms in the context of LBP or sciatica. The most common cause of CES is lumbar disc herniation at the L4-L5 and L5-S1 levels. Multifocal deficits and progressive neurologic deficits can be caused by a number of other etiologies, such as neoplasm, infection, or other space-occupying lesions. The imaging study of choice in the evaluation of suspected CES, multifocal deficit, or progressive neurologic deficit remains MRI due to its ability to accurately depict soft tissue pathology, assess vertebral marrow, and assess the spinal canal patency. For those patients with nondiagnostic MRI or in whom MRI is contraindicated, x-ray myelography with post-myelography CT of the spine can be used as an alternative.

Summary of Recommendations

- Uncomplicated acute LBP and/or radiculopathy are benign, self-limited conditions that do not warrant any imaging studies.
- MRI of the lumbar spine should be considered for those patients presenting with red flags raising suspicion for a serious underlying condition, such as CES, malignancy, or infection.
- In patients with a history of low-velocity trauma, osteoporosis, or chronic steroid use, initial evaluation with radiographs is recommended.
- In the absence of red flags, first-line treatment for chronic LBP remains conservative therapy with both pharmacologic and nonpharmacologic (e.g., exercise, remaining active) therapy.
- If there are persistent or progressive symptoms during or following 6 weeks of conservative management and the patient is a surgery or intervention candidate or diagnostic uncertainty remains, MRI of the lumbar spine has become the initial imaging modality of choice in evaluating complicated LBP.
- MRI is the imaging procedure of choice in patients suspected of cord compression or spinal cord injury.
- Patients with recurrent LBP and history of prior surgical intervention should be evaluated with contrast-enhanced MRI.

Abbreviations

- CT, computed tomography
- FDG-PET, fluorine-18-2-fluoro-2-deoxy-D-glucose positron emission tomography
- MRI, magnetic resonance imaging
- SPECT, single-photon emission computed tomography
- Tc, technetium

Relative Radiation Level Designations

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
O	0 mSv	0 mSv
☢	<0.1 mSv	<0.03 mSv
☢☢	0.1-1 mSv	0.03-0.3 mSv
☢☢☢	1-10 mSv	0.3-3 mSv
☢☢☢☢	10-30 mSv	3-10 mSv
☢☢☢☢☢	30-100 mSv	10-30 mSv

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range

*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (e.g., region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as "Varies."

Clinical Algorithm(s)

Algorithms were not developed from criteria guidelines.

Scope

Disease/Condition(s)

Low back pain (LBP) with or without radiculopathy

Guideline Category

Diagnosis

Evaluation

Clinical Specialty

Family Practice

Internal Medicine

Neurological Surgery

Neurology

Nuclear Medicine

Orthopedic Surgery

Radiology

Intended Users

Advanced Practice Nurses

Health Plans

Hospitals

Managed Care Organizations

Physician Assistants

Physicians

Students

Utilization Management

Guideline Objective(s)

To evaluate the appropriateness of imaging procedure for patients with low back pain (LBP) with or without radiculopathy

Target Population

Patients with low back pain (LBP) with or without radiculopathy

Interventions and Practices Considered

1. Magnetic resonance imaging (MRI), lumbar spine
    - Without contrast
    - Without and with contrast
2. Computed tomography (CT), lumbar spine
    - With contrast
    - Without contrast
    - Without and with contrast
3. X-ray
    - Lumbar spine
    - X-ray discography and post-discography CT, lumbar spine
    - X-ray myelography and post-myelography CT, lumbar spine
4. Technetium (Tc)-99m bone scan
    - With single-photon emission computed tomography (SPECT), spine
    - Whole body with SPECT, spine

Major Outcomes Considered

- Utility of imaging modalities in evaluating patients with low back pain (LBP)
- Sensitivity, specificity, and diagnostic accuracy of imaging modalities in evaluating LBP

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Literature Search Summary

Of the 48 citations in the original bibliography, 13 were retained in the final document. Articles were removed from the original bibliography if they were more than 10 years old and did not contribute to the evidence or they were no longer cited in the revised narrative text.

A new literature search was conducted in December 2013 to identify additional evidence published since the *ACR Appropriateness Criteria*® *Low Back Pain* topic was finalized. Using the search strategy described in the literature search companion (see the "Availability of Companion Documents" field), 294 articles were found. No articles were added to the bibliography due to either poor study design, the articles were not relevant or generalizable to the topic, the results were unclear, misinterpreted, or biased, or the articles were already cited in the original bibliography.

The author added 16 citations from bibliographies, Web sites, or books that were not found in the new literature search.

One citation is a supporting document that was added by staff.

See also the American College of Radiology (ACR) Appropriateness Criteria® literature search process document (see the "Availability of Companion Documents" field) for further information.

Number of Source Documents

Of the 48 citations in the original bibliography, 13 were retained in the final document. The new literature search conducted in December 2013 did not identify any articles that could be added to the bibliography. The author added 16 citations from bibliographies, Web sites, or books that were not found in the new literature search. One citation is a supporting document that was added by staff.

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Definitions of Study Quality Categories

Category 1 - The study is well-designed and accounts for common biases.

Category 2 - The study is moderately well-designed and accounts for most common biases.

Category 3 - The study has important study design limitations.

Category 4 - The study or source is not useful as primary evidence. The article may not be a clinical study, the study design is invalid, or conclusions are based on expert consensus.

> The study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description);
>
> *Or*
>
> The study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence;
>
> *Or*
>
> The study is an expert opinion or consensus document.

Category M - Meta-analysis studies are not rated for study quality using the study element method because the method is designed to evaluate individual studies only. An "M" for the study quality will indicate that the study quality has not been evaluated for the meta-analysis study.

Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

The topic author assesses the literature then drafts or revises the narrative summarizing the evidence found in the literature. American College of Radiology (ACR) staff drafts an evidence table based on the analysis of the selected literature. These tables rate the study quality for each article included in the narrative.

The expert panel reviews the narrative, evidence table and the supporting literature for each of the topic-variant combinations and assigns an

appropriateness rating for each procedure listed in the variant table(s). Each individual panel member assigns a rating based on his/her interpretation of the available evidence.

More information about the evidence table development process can be found in the ACR Appropriateness Criteria® Evidence Table Development document (see the "Availability of Companion Documents" field).

Methods Used to Formulate the Recommendations

Expert Consensus (Delphi)

Description of Methods Used to Formulate the Recommendations

Rating Appropriateness

The American College of Radiology (ACR) Appropriateness Criteria (AC) methodology is based on the RAND/UCLA Appropriateness Method. The appropriateness ratings for each of the procedures or treatments included in the AC topics are determined using a modified Delphi method. An initial survey is conducted to elicit each panelist's expert interpretation of the evidence, based on the available data, regarding the appropriateness of an imaging or therapeutic procedure for a specific clinical scenario. The expert panel members review the evidence presented and assess the risks or harms of doing the procedure balanced with the benefits of performing the procedure. The direct or indirect costs of a procedure are not considered as a risk or harm when determining appropriateness (additional assumptions regarding rating appropriateness can be found in the document Rating Round Information). When the evidence for a specific topic and variant is uncertain or incomplete, expert opinion may supplement the available evidence or may be the sole source for assessing the appropriateness.

The appropriateness is represented on an ordinal scale that uses integers from 1 to 9 grouped into three categories: 1, 2, or 3 are in the category "usually not appropriate" where the harms of doing the procedure outweigh the benefits; and 7, 8, or 9 are in the category "usually appropriate" where the benefits of doing a procedure outweigh the harms or risks. The middle category, designated "may be appropriate," is represented by 4, 5, or 6 on the scale. The middle category is when the risks and benefits are equivocal or unclear, the dispersion of the individual ratings from the group median rating is too large (i.e., disagreement), the evidence is contradictory or unclear, or there are special circumstances or subpopulations which could influence the risks or benefits that are embedded in the variant.

The ratings assigned by each panel member are presented in a table displaying the frequency distribution of the ratings without identifying which members provided any particular rating. To determine the panel's recommendation, the rating category that contains the median group rating without disagreement is selected. This may be determined after either the first or second rating round. If there is disagreement after the first rating round, a conference call is scheduled to discuss the evidence and, if needed, clarify the variant or procedure description. If there is still disagreement after the second rating round, the recommendation is "may be appropriate."

This modified Delphi method enables each panelist to articulate his or her individual interpretations of the evidence or expert opinion without excessive influence from fellow panelists in a simple, standardized, and economical process. For additional information on the ratings process see the Rating Round Information document.

Additional methodology documents, including a more detailed explanation of the complete topic development process and all ACR AC topics can be found on the ACR Web site (see also the "Availability of Companion Documents" field).

Rating Scheme for the Strength of the Recommendations

Not applicable

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Internal Peer Review

Description of Method of Guideline Validation

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria (AC).

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The recommendations are based on analysis of the current medical evidence literature and the application of the RAND/UCLA appropriateness method and expert panel consensus.

Summary of Evidence

Of the 30 references cited in the *ACR Appropriateness Criteria® Low Back Pain* document, all of them are categorized as diagnostic references including 3 well designed studies, 2 good quality studies, and 7 quality studies that may have design limitations. There are 18 references that may not be useful as primary evidence.

While there are references that report on studies with design limitations, 5 well designed or good quality studies provide good evidence.

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Selection of appropriate radiologic imaging procedures for evaluation of patients with low back pain (LBP) with or without radiculopathy

Potential Harms

Relative Radiation Level

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, both because of organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared to those specified for adults. Additional information regarding radiation dose assessment for imaging examinations can be found in the ACR Appropriateness Criteria® Radiation Dose Assessment Introduction document (see the "Availability of Companion Documents" field).

Qualifying Statements

Qualifying Statements

- The American College of Radiology (ACR) Committee on Appropriateness Criteria (AC) and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments.

Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

- ACR seeks and encourages collaboration with other organizations on the development of the ACR AC through society representation on expert panels. Participation by representatives from collaborating societies on the expert panel does not necessarily imply individual or society endorsement of the final document.
- The views expressed in this manuscript are those of the author and do not reflect the official policy of the Department of Army/Navy/Air Force, Department of Defense, or United States Government.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

Living with Illness

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

Patel ND, Broderick DF, Burns J, Deshmukh TK, Fries IB, Harvey HB, Holly L, Hunt CH, Jagadeesan BD, Kennedy TA, O'Toole JE, Perlmutter JS, Policeni B, Rosenow JM, Shroeder JW, Whitehead MT, Cornelius RS, Corey AS, Expert Panel on Neurologic Imaging. ACR Appropriateness CriteriaÂ® low back pain. Reston (VA): American College of Radiology (ACR); 2015. 12 p. [30 references]

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2015

Guideline Developer(s)

American College of Radiology - Medical Specialty Society

Source(s) of Funding

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria®.

Guideline Committee

Committee on Appropriateness Criteria, Expert Panel on Neurologic Imaging

Composition of Group That Authored the Guideline

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Financial Disclosures/Conflicts of Interest

Not stated

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Davis PC, Wippold FJ II, Cornelius RS, Angtuaco EJ, Broderick DF, Brown DC, Garvin CF, Hartl R, Holly L, McConnell CT Jr, Mechtler LL, Rosenow JM, Seidenwurm DJ, Smirniotopoulos JG, Expert Panel on Neurologic Imaging. ACR Appropriateness Criteria® low back pain. [online publication]. Reston (VA): American College of Radiology (ACR); 2011. 8 p. [48 references]

This guideline meets NGC's 2013 (revised) inclusion criteria.

Guideline Availability

Available from the American College of Radiology (ACR) Web site .

Availability of Companion Documents

The following are available:

- ACR Appropriateness Criteria®. Overview. Reston (VA): American College of Radiology; 2015 Oct. 3 p. Available from the American College of Radiology (ACR) Web site .
- ACR Appropriateness Criteria®. Literature search process. Reston (VA): American College of Radiology; 2015 Feb. 1 p. Available from the ACR Web site .
- ACR Appropriateness Criteria®. Evidence table development. Reston (VA): American College of Radiology; 2015 Nov. 5 p. Available from the ACR Web site .
- ACR Appropriateness Criteria®. Topic development process. Reston (VA): American College of Radiology; 2015 Nov. 2 p. Available from the ACR Web site .
- ACR Appropriateness Criteria®. Rating round information. Reston (VA): American College of Radiology; 2015 Apr. 5 p. Available from the ACR Web site .

- ACR Appropriateness Criteria®. Radiation dose assessment introduction. Reston (VA): American College of Radiology; 2015 Sep. 3 p. Available from the ACR Web site.
- ACR Appropriateness Criteria®. Manual on contrast media. Reston (VA): American College of Radiology; 2015. 129 p. Available from the ACR Web site.
- ACR Appropriateness Criteria®. Procedure information. Reston (VA): American College of Radiology; 2015 Jul. 2 p. Available from the ACR Web site.
- ACR Appropriateness Criteria® low back pain. Evidence table. Reston (VA): American College of Radiology; 2015. 10 p. Available from the ACR Web site.
- ACR Appropriateness Criteria® low back pain. Literature search. Reston (VA): American College of Radiology; 2015. 1 p. Available from the ACR Web site.

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI on July 31, 2001. The information was verified by the guideline developer as of August 24, 2001. This summary was updated by ECRI on March 28, 2006. This summary was updated by ECRI Institute on May 17, 2007 following the U.S. Food and Drug Administration (FDA) advisory on Gadolinium-based contrast agents. This summary was updated by ECRI Institute on June 20, 2007 following the U.S. Food and Drug Administration (FDA) advisory on gadolinium-based contrast agents. This summary was updated by ECRI Institute on July 1, 2009. This summary was updated by ECRI Institute on January 13, 2011 following the U.S. Food and Drug Administration (FDA) advisory on gadolinium-based contrast agents. This summary was updated by ECRI Institute on February 28, 2012. This summary was updated by ECRI Institute on September 18, 2015 following the U.S. Food and Drug Administration advisory on non-aspirin nonsteroidal anti-inflammatory drugs (NSAIDs). This summary was updated by ECRI Institute on January 22, 2016.

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